Renal Pathology

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Renal Pathology Outline

• Introductory stuff
• Glomerular diseases
• Tubular and interstitial diseases
• Diseases involving blood vessels
• Cystic diseases
• Tumors
Renal Pathology Outline

- Introductory stuff
Introductory Stuff

- Functions of the kidney:
  - excretion of waste products
  - regulation of water/salt
  - maintenance of acid/base balance
  - secretion of hormones

- Diseases of the kidney
  - glomeruli
  - tubules
  - interstitium
  - vessels
Introductory Stuff

- Azotemia: ↑ BUN, creatinine
- Uremia: azotemia + more problems
- Acute renal failure: oliguria
- Chronic renal failure: prolonged uremia
 Introductory Stuff

Nephrotic syndrome
- Massive proteinuria
- Hypoalbuminemia
- Edema
- Hyperlipidemia/-uria

Nephritic syndrome
- Hematuria
- Oliguria
- Azotemia
- Hypertension
Nephrotic Syndrome

- Leaky glomerulus lets protein out
- Resorption droplets
- >3.5 gm/day proteinuria
- High LDL's
- Severe edema
- Hypoalbuminemia
- Heavy urinary protein loss
- Protein foam
Nephritic syndrome

Inflamed glomerulus compromises blood flow and filtration

Oliguria
Hematuria
Azotemia
Hypertension
Mild edema

red cell cast

red cell
Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
Renal Pathology Outline

• Introductory stuff

• Glomerular diseases
  • Nephrotic syndrome
    • Minimal change disease
    • Focal segmental glomerulosclerosis
    • Membranous nephropathy
  • Nephritic syndrome
    • Postinfectious GN
    • IgA nephropathy
Renal Pathology Outline

- Introductory stuff
- Glomerular diseases
  - Nephrotic syndrome
Symptoms of Nephrotic Syndrome

- Massive proteinuria
- Hypoalbuminemia
- Edema
- Hyperlipidemia, lipiduria
Causes of Nephrotic Syndrome

- Adults: systemic disease (diabetes)
- Children: minimal change disease
- Characterized by loss of foot processes
Renal Pathology Outline

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- Glomerular diseases
  - Nephrotic syndrome
    - Minimal change disease
Minimal Change Disease

Things You Must Know

- #1 cause of nephrotic syndrome in children
- Loss of foot processes
- Pathogenesis unknown
- Good prognosis
Minimal change disease
Normal glomerulus
Minimal change disease
Normal glomerulus
Minimal change disease

Podocyte with effaced foot processes

Normal basement membrane
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    - Minimal change disease
    - Focal segmental glomerulosclerosis
Focal Segmental Glomerulosclerosis

Things You Must Know

- Primary or secondary (HIV, heroin, hypertension)
- Some (focal) glomeruli show partial (segmental) hyalinization
- Unknown pathogenesis
- Poor prognosis
Focal segmental glomerulosclerosis
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    • Focal segmental glomerulosclerosis
    • Membranous nephropathy
Membranous Nephropathy

Things You Must Know

- Autoimmune reaction against unknown renal antigen
- Immune complexes
- Thickened GBM
- Subepithelial deposits/spikes
Membranous nephropathy
Membranous nephropathy
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    - Focal segmental glomerulosclerosis
    - Membranous nephropathy
  - Nephritic syndrome
Symptoms of Nephritic Syndrome

- Hematuria
- Oliguria, azotemia
- Hypertension
Causes of Nephritic Syndrome

- Post-infectious GN, IgA nephropathy
- Immunologically-mediated
- Characterized by proliferative changes and inflammation
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    - Membranous nephropathy
  - Nephritic syndrome
    - Postinfectious GN
Post-Infectious Glomerulonephritis

Things You Must Know

- Child after strep throat
- Immune complexes
- Hypercellular glomeruli
- Subepithelial humps
Post-Infectious Glomerulonephritis

“Sore throat, face bloat, pee coke”
Post-infectious glomerulonephritis
Post-infectious glomerulonephritis
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  - Nephritic syndrome
    - Postinfectious GN
    - IgA nephropathy
IgA Nephropathy

Things You Must Know

- Common!
- Child with hematuria after URI
- IgA in mesangium
- Variable prognosis
IgA nephropathy
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- Tubular and interstitial diseases
  - Inflammatory lesions
    - pyelonephritis
    - drug-induced interstitial nephritis
  - Toxic/ischemic lesions
    - Acute tubular necrosis
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- Introductory stuff
- Glomerular diseases
- Tubular and interstitial diseases
  - Inflammatory lesions
    - pyelonephritis
Pyelonephritis

Things You Must Know

- Invasive kidney infection
- Usually ascends from UTI
- Fever, flank pain
- Organisms: E. coli, Proteus
Acute pyelonephritis with abscesses
Acute pyelonephritis
Acute pyelonephritis
Cellular cast
HEMATOGENOUS INFECTION
Common agents:
- Staphylococcus
- E. coli

Bacteremia

Aorta

Intrarenal reflux

Vesicoureteral reflux

Deranged vesicoureteral junction

Bacteria enter bladder

Bacterial colonization

ASCENDING INFECTION
Common agents:
- E. coli
- Proteus
- Enterobacter
Urinary Tract Infection

- Women, elderly
- Patients with catheters or malformations
- Dysuria, frequency
- Organisms: E. coli, Proteus
UTI: Common Bugs

E. coli

uncomplicated

complicated
Urinary catheter colonized by Proteus
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    - pyelonephritis
    - drug-induced interstitial nephritis
Drug-Induced Interstitial Nephritis

Things You Must Know

- Antibiotics, NSAIDS
- IgE and T-cell-mediated immune reaction
- Fever, eosinophilia, hematuria
- Patient usually recovers
- Analgesic nephritis is different (bad)
Drug-induced interstitial nephritis
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    • drug-induced interstitial nephritis
  • Toxic/ischemic lesions
    • Acute tubular necrosis
Acute Tubular Necrosis

Things You Must Know

- The most common cause of ARF!
- Reversible tubular injury
- Many causes: ischemic (shock), toxic (drugs)
- Most patients recover
Acute tubular necrosis
Acute tubular necrosis
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- Diseases involving blood vessels
  - Benign nephrosclerosis
  - Malignant nephrosclerosis
Benign Nephrosclerosis

Things You Must Know

- Found in patients with benign hypertension
- Hyaline thickening of arterial walls
- Leads to mild functional impairment
- Rarely fatal
Benign nephrosclerosis
Malignant Nephrosclerosis

Things You Must Know

- Arises in malignant hypertension
- Hyperplastic vessels
- Ischemia of kidney
- Medical emergency
Malignant Hypertension

- 5% of cases of hypertension
- Super-high blood pressure, encephalopathy, heart abnormalities
- First sign often headache, scotomas
- Decreased blood flow to kidney leads to increased renin, which leads to increased BP!
- 5y survival: 50%
Malignant nephrosclerosis
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- Cystic diseases
  - Adult polycystic kidney disease
  - Childhood polycystic kidney disease
Adult Polycystic Kidney Disease

Things You Must Know

- Autosomal dominant
- Huge kidneys full of cysts
- Usually no symptoms until 30s
- Associated with brain aneurysms
Adult polycystic kidney disease
Childhood Polycystic Kidney Disease

Things You Must Know

- Autosomal recessive
- Numerous small cortical cysts
- Associated with liver cysts
- Patients often die in infancy
Childhood polycystic kidney disease
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- Tumors
  - Renal cell carcinoma
  - Bladder carcinoma
Renal Cell Carcinoma

Things You Must Know

- Derived from tubular epithelium
- Smoking, hypertension, cadmium exposure
- Hematuria, abdominal mass, flank pain
- If metastatic, 5y survival = 5%
Renal cell carcinoma
Bladder Carcinoma

Things You Must Know

- Derived from transitional epithelium
- Presents with painless hematuria
- Prognosis depends on grade and depth of invasion
- Overall 5y survival = 50%
Bladder carcinoma
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